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10/580,797	05/26/2006	Alain Guillard	Serie 6423	7256

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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/580,797
Filing Date: May 26, 2006
Appellant(s): GUILLARD ET AL.

Elwood Haynes
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 6/29/10 appealing from the Office action mailed 3/1/10.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 13-19 and 21.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading “WITHDRAWN REJECTIONS.” New grounds of rejection (if any) are provided under the subheading “NEW GROUNDS OF REJECTION.”

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant’s brief.

(8) Evidence Relied Upon.

5,082,481	Barchas et al.	01-1992
6,808,017	Kaellis	10-2004
6,685,903	Wong et al.	02-2004

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13-19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barchas et al., US 5,082,481 in view of Kaellis, US 6,808,017.

<u>In regard to claims 13-15:</u>

Barchas discloses a gas compression system comprising 5 stages (12, 18, 24, 30, 36), each stage followed by a cooler system (14, 20, 26, 32, 48/50/52). The pressure of the gas leaving the first compressor stage 12 is between 25 and 40 psig and the outlet pressure of final compressor stage 36 is 450-650 psig. Barchas does not explicitly disclose that the pressure drop is higher through the last set of coolers than the first. However, cooler optimization tends to involve employing the highest pressure drop one can tolerate as this permits higher heat transfer coefficients; increasing tube and fin density, using a greater number of smaller diameter tubes, etc. increases heat transfer coefficient, but at some point the pressure drop increase leads to unacceptable pumping losses due to the higher pumping power required to obtain the desired throughflow. Kaellis teaches that a common goal in the design of heat exchangers “is to enhance heat transfer while trying to keep the associated pressure drop low, or in other words to maximize the ratio of the heat transfer coefficient to the pressure drop. The higher the pressure drop, the more energy must be expended to pump the fluids through heat exchanger” (column 1, lines 29-35). Barchas discloses only nominal coolers, but both for the reason that there is a set of three coolers in the final stage cooler system as opposed to single coolers at every other stage, and because the pressure is higher at the final stage so as to accomodate a cooler with a higher heat transfer coefficient that may have an accompanying higher pressure drop, it would have been obvious to one skilled in the art that, with the teaching of Kaellis, it would have

been an obvious engineering design choice to sacrifice more pressure drop at higher pressure to get a higher heat transfer coefficient out of the last cooler system.

<u>In regard to claims 16 and17:</u>

The final stage compressor, downstream from all other compressors, has a higher pressure drop due to the multiple coolers coming after the compression stage. In fact, with two coolers identical to each individual cooler in the prior stages, implied by the disclosure of Barchas, the pressure drop is 100% larger at this stage.

<u>In regard to claim 18:</u>

Barchas discloses that the unit is for separating a gas mixture (H_2) from a cracking effluent (Abstact).

<u>In regard to claim 19:</u>

Barchas discloses a cryogenic distillation unit comprising at least one distillation column 60 (col. 6, ll. 5-29), means for sending compressed gas to a column of the unit (via lines 59), means for withdrawing a liquid from a column of the unit (line 61), means for vaporizing the liquid by heat exchange with a compressed gas (where lines 45 and 61 meet), the compressed gas having been compressed by the final stage of the compressor.

<u>In regard to claim 21:</u>

Barchas discloses a method of separating a gas using cryogenic distillation whereby the gas is compressed in the compressor to a pressure of 550-650 psi at the final stage of the compressor.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 19 in view of Wong et al., US 6,685,903.

The references as applied to claim 19 teach all of the limitations substantially as claimed except for the following taught by Wong: a heat exchanger 114 for vaporizing the liquid coming from distillation column 120 using the gas coming from the second stage compressor 122. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the distillation column of Barchas with the heat exchanger system of Wong to cool the discharge liquid from the distillation column.

(10) Response to Argument

The examiner reiterates the basis for rejection articulated in the final action and restated in the advisory action mailed 4/29/10.

Barchas discloses the invention substantially as claimed including a gas compressor having multiple stages (12, 18, 24, 30 and 38) each followed by a cooler assembly (14, 20, 26, 32, and 48/50/52). Barchas lacks a specific statement teaching of the cooler of the lower pressure drop being upstream of that having the higher pressure drop. Please note that the final cooler assembly (48, 50, 52) includes three coolers arranged in series and considered a single cooler by the examiner. As shown in the

figure, each cooler is impliedly substantially the same. Furthermore, each cooler of Barchas is described as operating at a temperature between 80 and 120 degrees F. Therefore, if each cooler is considered to be the same make and model, the pressure drop through the cooler system after the final stage comprising three of the coolers of the preceding stages would be higher than the pressure drop through just one cooler. The Barchas coolers in the figures may only be taken at face value as being symbolic of generic coolers, but it would have been obvious to one of ordinary skill in the art presented with the disclosure of Barchas to try the invention with substantially the same coolers, as that is one of a finite number of options available to one of ordinary skill in the art.

Furthermore, one of ordinary skill would recognize that the pressure out of the final compressor stage of Barchas would be the highest pressure in the system. This high pressure is then fed into three coolers in series. Keeping in mind pV=nRT, and with each cooler disclosed at cooling the fluid to 80 to 120 degrees F, one of ordinary skill in the art would recognize that the cooler (48, 50, 52) in the final stage would result in the largest temperature drop in the system, thus resulting in the largest pressure drop across the coolers (48, 50, 52).

Even if the coolers are not interpreted as being the same make and model, or if one of ordinary skill in the art would not have found it obvious to try to implement the invention of Barchas with coolers of the same make and model, Kaellis teaches that it is well known in the art that cooler design is a matter of trade off between pressure drop and cooling efficiency. The examiner contends that this teaching in combination with

the teaching of Barchas that there are more coolers after the final stage would lead one of ordinary skill in the art to the conclusion that it was obvious that Barchas intended greater cooling and therefore a higher pressure drop through the final stages, and that is why the invention provided three cooler stages whereas only one cooler stage was provided after each previous compressor stage. It would have at least been obvious to one of ordinary skill in the art that this would be the outcome of Barchas's invention, if not the intention.

The last reason stated previously is that the pressure drop would be higher through the final stage because of the higher pressure in this stage. The examiner does not contend, as applicant argues, that the higher pressure in the stage causes a higher pressure drop, but simply that the higher pressure would accommodate a higher pressure drop, so that one skilled in the art would be able to trade off some pressure drop for cooler efficiency, as taught by Kaellis. As applicant contends, one of ordinary skill in the art would like to preserve all, or as much as possible, of the pressure buildup through each compressor stage, but it would at least be obvious to one of ordinary skill that how much pressure drop is sacrificed is a design choice based on the desired cooler efficiency. Additionally, it is likely that one of ordinary skill in the art would be prepared to accept a given percentage pressure drop after each stage (applicants arguments overlook the fact that the pressure increase from prior stage compressors may be just as valuable as the pressure increase in the final stage). A similar pressure drop after a higher pressure stage is greater in absolute numbers than a pressure drop

after an earlier, lower pressure stage, so that equally efficient coolers would result in a higher pressure drop after a final stage.

In addition to the responses to the arguments listed above, the examiner would also like to note an implication of the rejection and responses that had not been previously explicitly stated, namely that the grounds for rejection mirror closely the concept that a patent claim may be proved obvious by showing that the combination of elements was obvious to try. Significantly, there are only three options in compressor/cooler configuration when there is more than one compressor in a string, as is the case in the present application and the primary reference of Barchas. These options are: (a) the upstream and downstream coolers have identical pressure drops; (b) the downstream cooler has a greater pressure drop than the upstream cooler; or (c) the upstream cooler has a greater pressure drop than the downstream cooler. As best evidenced by the secondary reference to Kaellis, all three of these configurations would have a reasonable expectation of success, and the only difference would be the configuration designer's choice in the tradeoff between cooler efficiency and pressure preservation at each stage (see rejection above). However, each configuration provides a reasonable expectation of succeeding in compressing and cooling the fluid media. Therefore, it would have been obvious to a person having ordinary skill in the art to try the configuration whereby the cooler having the lower pressure drop is upstream of that having the higher pressure drop.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Patrick Hamo

Patent Examiner, AU 376

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